FOREST PRODUCTS LABORATORY † FOREST SERVICE
U. S. DEPARTMENT OF AGRICULTURE

SMALL SAWMILL IMPROVEMENT

PRACTICAL POINTERS TO FIELD AGENCIES

INSTRUCTIONS ON SAWING HARDWOOD LOGS AND EDGING AND TRIMMING HARDWOOD LUMBER FOR GRADE AND VALUE RECOVERY

Principles for grade-sawing logs are almost nonexistent in the sense of recommending a set procedure to be followed for all logs having like classes of defects. The recommendations given should lead to improved quality in a majority of such logs sawn and serve as a start in grounding sawyers on grade-sawing. With the experience gained in opening up logs a sawyer should explore how to extend grade recovery beyond the recommendations given.

To recover the highest possible value from a log, the high-grade material should be sawed to factory lumber and the lower-grade to factory lumber or to construction items. A common practice is to try to saw all material above No. 2 Common grade into factory lumber and to cut construction items from the other material that can qualify. The market price per thousand board feet for upper grades of factory lumber usually increases with stock thickness. Recommendations cannot be made that all small mills should cut thick stock, because the limited production at a small mill can result in excessive handling costs. The cutting policy with respect to the type of products from the lower-grade portions and the thick stock from the higher-grade portions should be determined for each individual mill.

The actual sawing practice for grade-sawing factory lumber should be to work the high-grade material from the better faces by taper-sawing them, as described later, before taking much from the poorer faces, and then to turn to a different face as the grade drops below that promised by adjoining faces. This process of working around the log is usually profitable if it results in raising the grade from No. 3 Common to No. 2 Common.

Dividing the Log to Faces, and Sequence in Turning

As the log is transferred to the carriage, decide on how it should be divided into four cutting faces and the probable sequence to be followed in sawing them. Deciding on one face automatically fixes the other three. A mirror at the deck end of the track reflecting a view of the end farthest from the sawyer as the log is against the knees is helpful in judging the influence of end defects in determining faces and probable sawing sequence.

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† Maintained at Madison 5, Wisconsin in cooperation with the University of Wisconsin

For clear, straight, sound logs with the pith at the approximate center it is immaterial how the log is divided into faces, and the cutting sequence from one face to the next is that involving the least delay. Thus, at mills turning down, the cant is turned down 90°. At mills turning up, the cant is turned at least 180° from the first face. If the pith is off-center, the log should be placed so that one face is perpendicular to the longest radius.

Logs with straight splits, wind shakes, or seams (fig. 1, A)[1] are placed so that the crack is at the board edge to be taken out in edging. Thus the log is placed so that the crack coincides with the radius halfway between the radius bisecting the first face and that to the bolster (fig. 1, B). However, if face 2 (fig. 1, B) promises high-quality material and hence should be taper-sawed, a slab is taken from face 4 before turning the log to the position indicated in figure 1, B. Sawing face 1, as indicated, automatically results in taper-sawing face 3. At right-hand mills turning down, the sequence is indicated by figure 1, B. At right-hand mills turning up, the sequence is usually faces 1, 3, 4, and 2.

Logs with spiral cracks (fig. 1, C) are placed so that one end of the crack is as for logs with straight cracks and the damaged zone is down and back toward the knees (fig. 1, D). At mills turning down, the first face is usually sawed until the crack appears on a board edge, then the other faces are successively worked; but where spiral cracks extend a third or more of the circumference, the unaffected faces are sawed deeply before recovering short pieces from affected faces (fig. 1, D). At mills turning up, face 1 is worked lightly, face 3 is slabbed, face 2 is worked deeply, face 1 is worked nearly to the pith, and then face 3 to finish.

Logs with ring shake, dote, or rot (fig. 2, A). When restricted to the center, these defects do not influence the manner of dividing the log to faces or sawing sequence. The unmerchantable core is boxed and discarded. Logs with shake or rot in the outer zone are placed onto the carriage so that a cutting face is parallel to the straight line connecting the ends of the arc of shake or the long axis of the rot area and the face affected is sawed last (fig. 2, B).

Logs with spider heart (fig. 2, C). Spider heart does not influence the manner of dividing the log to faces or sawing sequence. The spider heart is boxed and cut to low-grade material or discarded.

Logs with worm holes (grub, shot, or pin) (fig. 2, D) should be placed on the carriage so that faces visibly free from them are sawed prior to turning to the affected areas.

Indicators of degrading defects listed up to this point usually are detected from the ends of the log. Indicators detected from surface inspection, such as adventitious bud clusters (fig. 3, A), bird pecks

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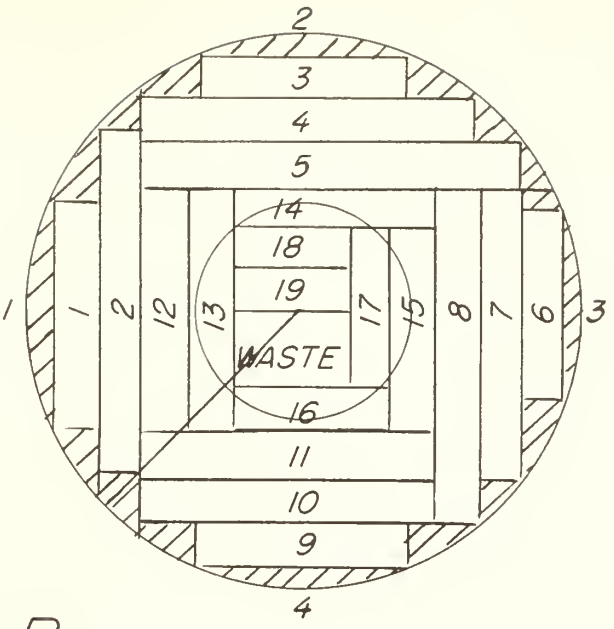
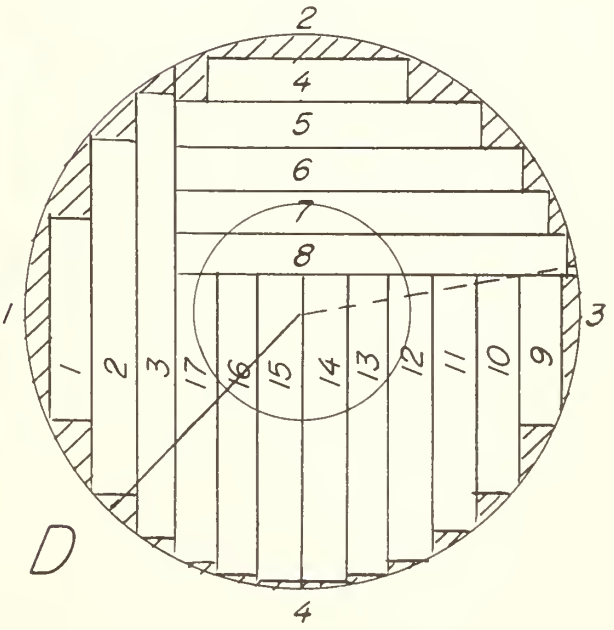
[1] All figures in this report except figures 1, C, 4, A, and the drawings are from U. S. Dept. of Agr. Handbook No. 4, "Log Defects in Southern Hardwoods." June 1950.

A



B

C



D

Figure 1.--A, straight seam; B, schematic drawing of cutting sequence for a log with a straight crack (right-hand mill); C, spiral seam; D, schematic drawing of cutting sequence for a log with a spiral crack (right-hand mill).

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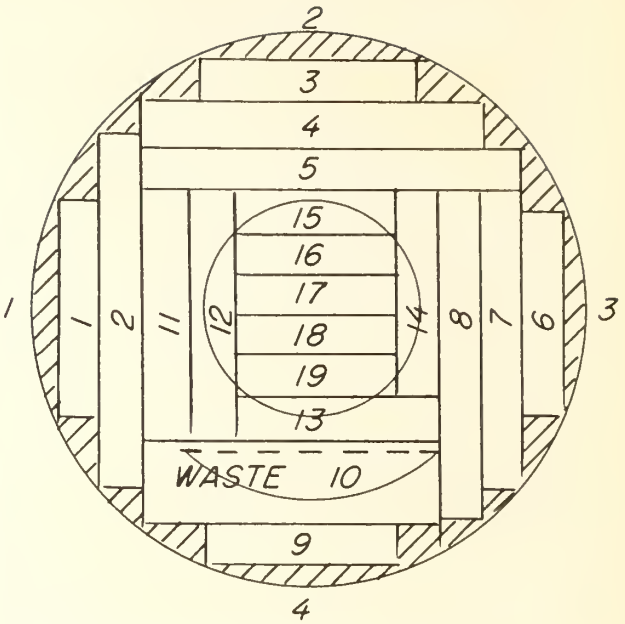
A



B

C

D

Figure 2.--A, ring shake; B, schematic drawing of cutting sequence for a log with ring shake (right-hand mill); C, spider heart; D, grub channels.

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A

B

C

D

Figure 3.--A, adventitious bud cluster; B, heavy bird peck; C, bump; D, burl.

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A

B

C

D

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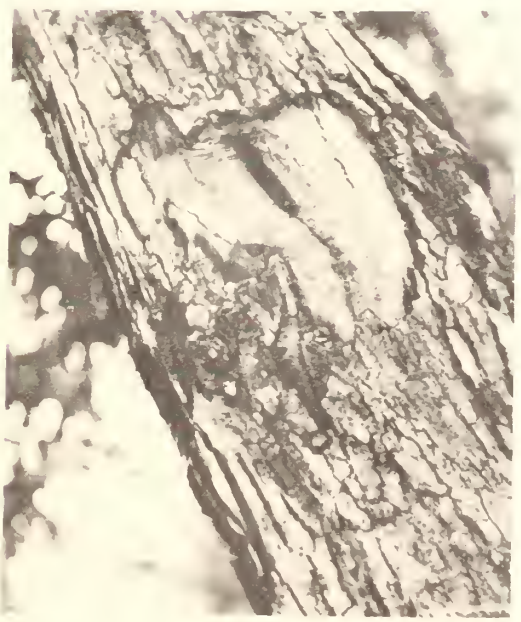
Figure 4.--A, canker; B, conk; C, hole; D, unsound knot.

A



B

Figure 5.--A, overgrowths; B, old wound.

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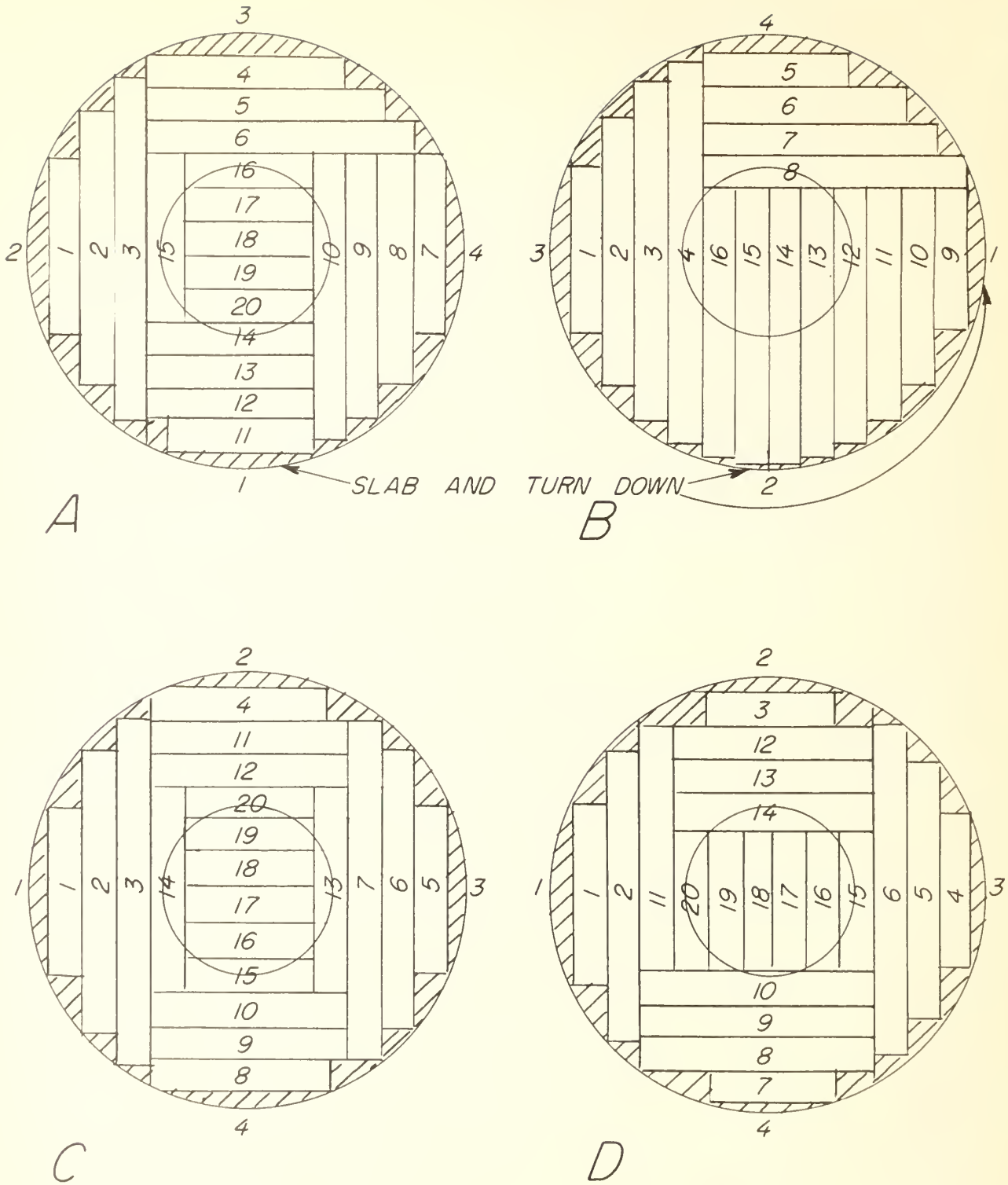


Figure 6.--Schematic drawings of cutting sequence: A, on log having three high-grade faces (right-hand mill); B, on log having two high-grade faces adjoining (right-hand mill); C, on log having two high-grade faces opposite (right-hand mill); D, on log having one high-grade face (right-hand mill).

(fig. 3, B), bulges, bumps (fig. 3, C), burls (fig. 3, D), butt scars, cankers (fig. 4, A), conks (fig. 4, B), holes (fig. 4, C), knots (fig. 4, D), overgrowths (fig. 5, A), and wounds (fig. 5, B), can be treated as a group in their influence on the manner of dividing the log into faces and sawing sequence. Logs will include the full range between those with few indicators affecting a localized area to many dispersed over the surface. Visualize the indicator-free perimeter zone as possible faces for initially placing the log and then successively turn the log so as to cut the high-grade material from these faces before cutting deeply into the defective ones. Thus, for a log with three high-grade faces, the defective one should be slabbed and turned down for mills turning down (fig. 6, A) and slabbed and turned up 180° for mills turning up, with the defective face being sawed last.

Logs with two high-grade faces adjoining are slabbed on each of the low-grade faces. On mills turning down, they are then placed with one high-grade face up and the other to the saw. After the first high-grade face is sawed, the log is turned down 90° (fig. 6, B). Where turning up is practiced, the log is placed with one low-grade face to the saw and the other up, is slabbed and turned 180°, and the high-grade face is worked to degrade, turned up 90°, slabbed, and turned 180° to the other high-grade face.

Logs with two opposite high-grade faces are placed with one to the saw regardless of the turning method. After the high-grade material is sawed from this face, the log is turned down 90° at mills having turn-down equipment, slabbed, and turned down 90°, and the high-grade material is sawed from the other good face (fig. 6, C). At mills having turn-up equipment, the log is turned 180° after the first face is sawed and the other good face is then sawed. In both cases high-grade faces are usually taper-sawed as described later.

A log having a single high-grade face is placed with this face against the knees. At mills turning down, a 90° turn is used for successive faces (fig. 6, D). At mills turning up, the sequence after sawing the first face is 180°, 90°, and 180°.

Where a clear face adjoins one having one or more defects that seem likely to be removed in edging, the log is placed so that these defects will be near the edge of the defective face; but cankers, conks, and holes are indicative of extensive defects not likely to be removed by edging, and hence should center the poor face.

Logs with sweep should be placed on the carriage with the crook out (fig. 7), and the four faces should be successively worked in the sequence dictated by turning equipment. Better grade recovery usually results from getting widest boards from the faces that are at the top and bottom in reference to the first face sawed.

Sawing the Log

It is important that the location of faces be fixed in accordance with the factors outlined. The high-grade faces are usually sawed parallel to the

bark, but the low-grade ones in the most convenient way to speed up the work. If a high-grade face is opposite a low-grade one, the good one will be sawed parallel to the bark either by placing the poor one against the knees and setting out the small end of the log or by simply placing the good face against the knees and slabbing the poor face first.

If high-grade faces are opposite, and for logs characteristically free of defects nearly to the pith (red oak, ash), the process is to place one good face against the knees and to saw the other without regard to parallelism, but not at first going far into this face. For logs characterized by interior defects that extend beyond the pith zone (sugar maple, birch), the process is to set out the small end enough to permit a slab of uniform width the full length of the log (fig. 8, A). When the opposite good face is turned to the saw, this process is repeated (fig. 8, B); but after this face is cut and before another is turned to, the cut is "straightened" by retracting the taper levers, setting the small end back against the knees, and sawing the face to produce a cant with opposite faces parallel (fig. 8, C). The intention is to take out the taper from the low-grade material in the core instead of from high-grade material in the outer zone.

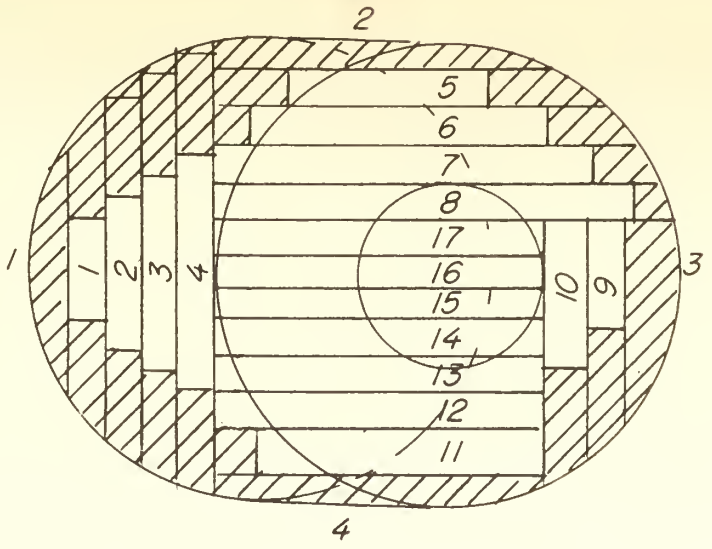
In slabbing parallel to the bark, the face of the slab should be the minimum width required by the prospective board grade -- 6-1/2 inches for grades above No. 1 Common and 3-1/2 inches for No. 1 Common or lower. When sawing any face, usually 4/4 lumber is taken from next to the slab to minimize edging waste, but when slabbing a face opposite to a previously sawed one, the sawyer slabs so that the final piece will conform to size requirements, thicknesses, or widths of the intended item. Faces indicative of high-grade material are sawed deeply; those indicative of low-grade, lightly. The usual practice is to continue sawing a face until the grade drops to that promised by the adjoining faces. This progressive turning continues until either the central portion is sized to meet construction-item specifications or until the grade improvement fails to pay. For small mills specializing in cutting factory lumber, such turning is justified so long as lumber better than No. 3 Common can be cut.

Edging

Material for factory outlets is normally edged to get the maximum width possible in inches and fractions; for construction-item outlets, it is edged to conform to definite width specifications.

Instructions on edging material for factory outlets

The minimum width for dry factory lumber is 6 inches for FAS and 3 inches for Common. Normally, a shrinkage allowance of 1/16 inch per inch of width is made, so that green FAS should be at least 6-3/8 inches and green Common at least 3-3/16 inches in width. Boards are usually edged with the narrower or bark face up.



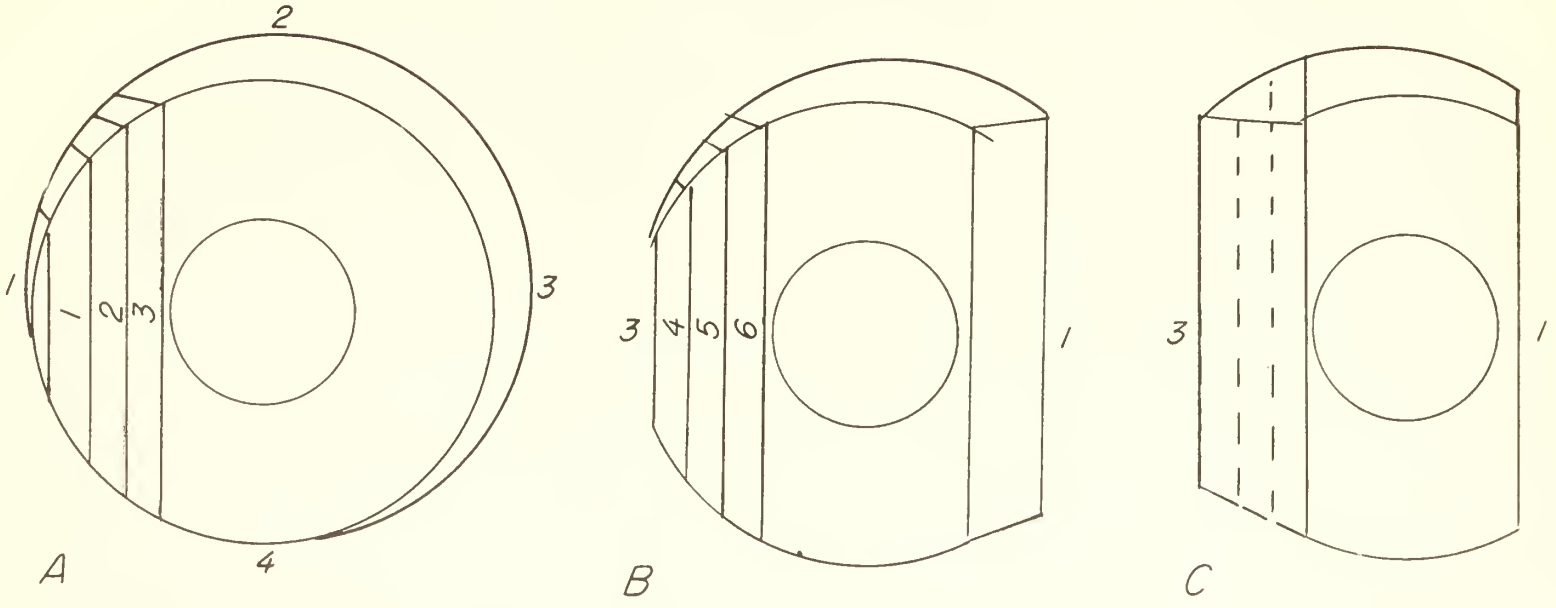


Figure 7 (top).--Schematic drawing of cutting sequence on log with sweep (right-hand mill).

Figure 8 (bottom).--Taper-sawing method by setting out small end of log. A, small end set out and boards cut parallel to bark; B, log turned 180°, small end set out and boards cut parallel to bark; C, small end set back against knees and cant cut to parallel sides.

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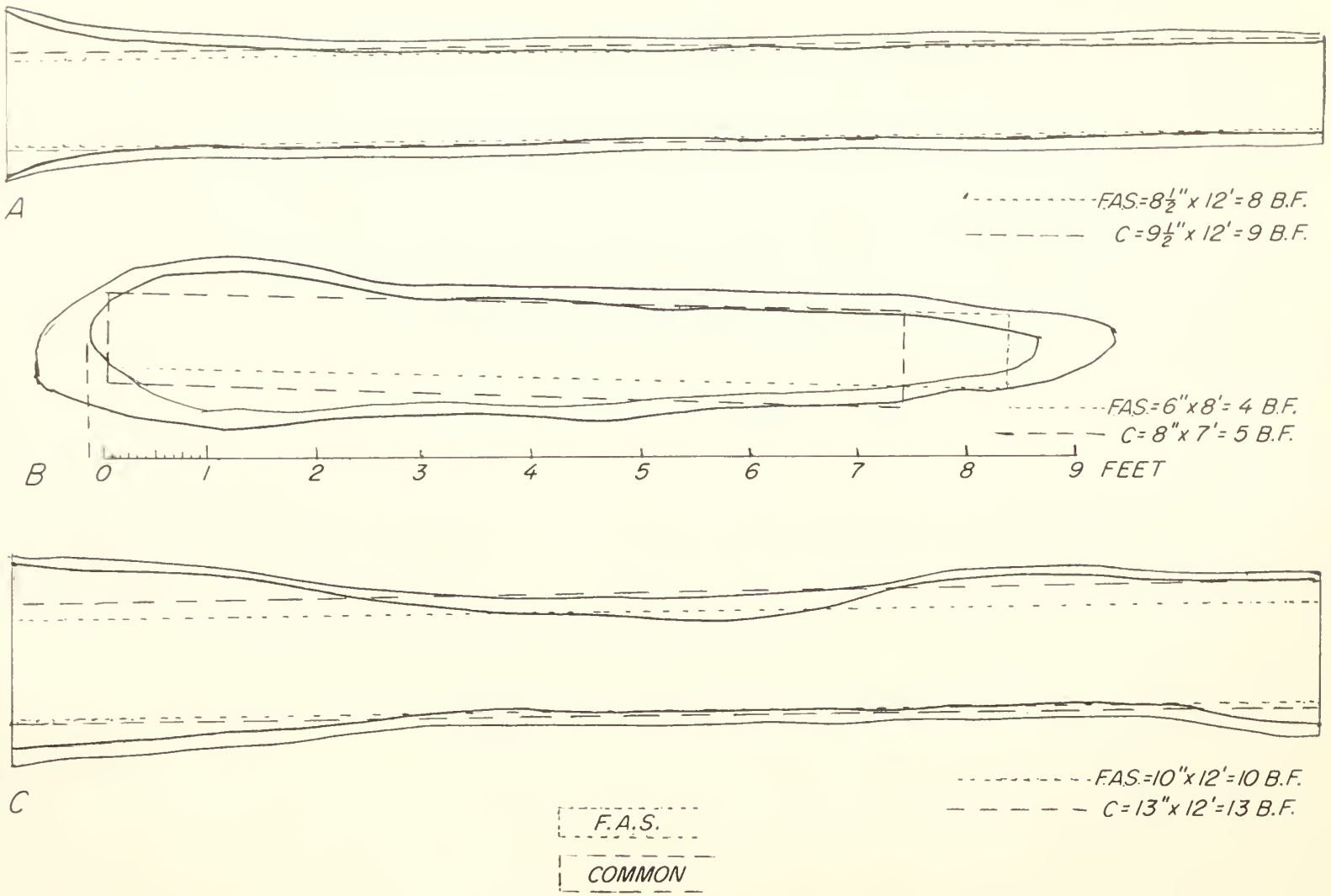

Figure 9.--Schematic drawing of suggested edging and trimming for three variations encountered. A, indicated edging for common and select grades on a butt cut; B, for common and select grades on a cut with feather ends; and C, for common and select grades on a wasp-waist type of cut.

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Boards below FAS are edged so that the surface area of the wane or rot left on the board is approximately equal to the area of sawed, sound face of the edging (fig. 9). For FAS, wane and rot cannot exceed one-twelfth the surface measure nor aggregate more than one-half the length of the piece. Shakes and splits in FAS cannot aggregate in inches more than twice the surface measure of the piece in feet nor diverge more than 1 inch per foot of length unless they aggregate 1 foot or less in length. Remove by ripping or trimming or both if they violate the above in FAS or extend more than one-third the length in Common grades.

All pieces exceeding 16 inches in width should be ripped if the grade of the resulting two boards does not fall below that of the wide piece.

Rip to raise grade when one-half or more of the original surface measure is raised at least one grade.

Instructions on edging material for construction outlets

Material is edged to conform to definite width specifications for the item. Items may be made from a limited number of species and sized to a restricted series of widths, thicknesses, and lengths, as for car stock and construction boards. The sawyer, edgerman, and trimmer must know the size, species, and allowable-defect provisions for such items. The 1/16-inch allowance per inch of width should be made for shrinkage from green to dry condition. Material in thicknesses exceeding 3 inches is normally edged on the headsaw, and since a high percentage of all construction items is produced by the headsaw from squared cants no edge work is required. The small amount requiring edging is subject to the size and quality specifications for the particular product. These products are usually diverse, and general edging instructions applying to them are impossible of formulation.

Trimming

For factory outlets

Trim each piece 2 inches over the nominal foot, and for boards below FAS trim so that the surface area of the wane or rot left on the board is approximately equal to the area of the sawed, sound face of the trim (fig. 9,B). Where the sawed face does not reach the board end (feather ends) (fig. 9,B), the termination of the sawed face is regarded as the board end. For FAS, wane or rot in excess of one-fourth the affected area within 1 foot of the end must be trimmed, and at least one-half the area of this last foot must have clear face. The rule stated for edging splits in FAS also applies to trimming them; viz., trim so that splits aggregate no more in inches in length than twice the surface measure in feet, nor diverge more than 1 inch to the foot in length, except when 1 foot or shorter.

For construction outlets

Trim each item to conform with specific length requirements and with wane, shake, or crack provisions for the item as listed in the specifications.

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